APPENDIX G

NOISE ASSESSMENT

Page intentionally left blank

988 HOWARD AVENUE PROJECT ENVIRONMENTAL NOISE ASSESSMENT BURLINGAME, CALIFORNIA

October 22, 2015

Prepared for:

Audrey M. Zagazeta
Project Director
Circlepoint
40 A/B S First Street
San Jose, CA 95113

Prepared by:

Jordan L. Roberts

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
1 Willowbrook Court, Suite 120
Petaluma, CA 94954
(707) 794-0400

Project No.: 15-164

INTRODUCTION

This report presents the results of the noise assessment conducted for the proposed development of a three-story office building located at 988 Howard Avenue in Burlingame, California. The Site is currently developed with a gas station and an automotive repair shop. The proposed Project is to demolish the existing buildings and to redevelop the Site with the office building, a ground-level parking area, and public plazas adjacent to retail spaces. Under the project conditions, the proposed office building would be a three-story structure of approximately 55 feet in height with a footprint of 11,160 SF. The building would consist of two stories of commercial uses (22,295 SF) above a ground level with a lobby, 1,325 SF of retail uses, and 68 spaces of parking. A 3,800 SF exterior commercial roof deck is also proposed as part of the project.

The Setting Section presents the fundamentals of environmental noise and vibration, provides a discussion of policies and standards applicable to the project, establishes the baseline noise environment, and the results of updated noise measurements made in the vicinity of the Project. The Impacts and Mitigation Measures Section establishes the thresholds of significance, assesses the potential noise and vibration impacts resulting from the project, and recommends measures to reduce significant impacts to a less-than-significant level.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (*frequency*) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. *A decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the *sound level meter*. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (L_{dn}) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the Peak Particle Velocity (PPV) and another is the Root Mean Square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration. In this section, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce. The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels such as people in an urban environment may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

Railroad and light-rail operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of railroad track. People's response to ground vibration has been correlated best with the velocity of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1 x 10^{-6} in/sec RMS, which equals 0 VdB, and 1 in/sec equals 120 VdB. Although not a universally accepted notation, the abbreviation "VdB" is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

Typical background vibration levels in residential areas are usually 50 VdB or lower, well below the threshold of perception for most humans. Perceptible vibration levels inside residences are attributed to the operation of heating and air conditioning systems, door slams and foot traffic. Construction activities, train operations, and street traffic are some of the most common external sources of vibration that can be perceptible inside residences. Table 4 illustrates some common sources of vibration and the association to human perception or the potential for structural damage.

TABLE 1 Definitions of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), Caltrans, September 2013.

TABLE 3 Reaction of People and Damage to Buildings at Various Continuous Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	Vibration unlikely to cause damage to any type of structure
0.04	Distinctly perceptible	
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.4	Severe	Threshold at which there is a risk of damage to newer residential structures and modern industrial /commercial buildings
0.5	Severe	

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

TABLE 4 Typical Levels of Groundborne Vibration

Human/Structural Response	Velocity Level, VdB	Typical Events (50-foot setback)
Threshold, minor cosmetic damage	100	Blasting, pile driving, vibratory compaction equipment
		Heavy tracked vehicles (Bulldozers, cranes, drill rigs)
Difficulty with tasks such as reading a video or computer screen	90	
		Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, occasional events		Commuter rail, typical Bus or truck over bump or on rough roads
Residential annoyance, frequent events	70	Rapid transit, typical
Approximate human threshold of perception to vibration		Buses, trucks and heavy street traffic
	60	
		Background vibration in residential settings in the absence of activity
Lower limit for equipment ultra-sensitive to vibration	50	

Source: Transit Noise and Vibration Impact Assessment, US Department of Transportation Federal Transit Administration, May 2006.

Regulatory Background

The State of California, California Building Code, and the City of Burlingame have established regulatory criteria that are applicable in this assessment. The California Environmental Quality Act (CEQA) Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;

(b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

(e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels; or

(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels.

CEQA does not define what noise level increase would be considered substantial. Typically, project-generated noise level increases of 3 dBA CNEL or greater would be considered significant where exterior noise levels would exceed the normally acceptable noise level standard (60 dBA CNEL). Where noise levels would remain at or below the normally acceptable noise level standard with the project, noise level increases of 5 dBA CNEL or greater would be considered significant. The project is not located within the influence area of a public airfield or private airstrip so the last two checklist questions are not carried forward for further analysis.

2010 California Building* Cal Green *Code. The State of California established exterior sound transmission control standards for new non-residential buildings as set forth in the 2010 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). These standards were not altered in the 2013 revisions, and the sections that pertain to this project are as follows:

> **5.507.4.1 Exterior noise transmission, prescriptive method.** Wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall meet a

composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA CNEL noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.

5.507.4.2 Performance method. For buildings located, as defined by Section 5.507.4.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

Noise Element of the City of Burlingame General Plan. The Noise Element of the General Plan sets forth noise and land use compatibility standards to guide development, and noise goals and policies to protect citizens from the harmful and annoying effects of excessive noise. Suggested outdoor noise levels suitable for single- and multi-family residential land uses would range up to 60 dBA CNEL, according to the General Plan. The suggested maximum outdoor noise levels for various land uses were provided in Table 4-2 of the General Plan and are shown in Table 5 in this report. The General Plan also establishes the indoor noise level planning criterion to be 45 dBA CNEL.

The City of Burlingame General Plan establishes recommended noise emission standards for construction equipment operating within the City in Table 4-6 of the General Plan. This table is summarized in Table 6. The General Plan also states that no construction noise shall be emitted passed the property line so as to create a noise level increase of more than 5 dBA L_{max} above ambient L_{max} noise levels.

TABLE 5 Maximum Outdoor Noise Levels (dBA)

Land Use Categories	CNEL
Public, Quasi-Public and Residential: Schools, hospitals, libraries, auditoriums, intensively-used parks and playgrounds, public buildings, single-family home, multiple family apartments and condominiums, mobile home parks	60
Passively-Used Open Space: Wilderness-type parks, nature or contemplation areas of public parks	45
Commercial: Shopping centers, self-generative business, commercial districts, offices, banks, clinics, hotels and motels	65
Industrial: Non-manufacturing industry, transportation, communications, utilities, manufacturing	75

Source: City of Burlingame General Plan: Noise Element, City of Burlingame, September 1975.

TABLE 6 Maximum Allowable Noise Levels from Construction Equipment

Equipment	Peak Noise Level in dBA at 50 feet
Earthmoving:	
Front loader	75
Backhoes	75
Dozers	75
Tractors	75
Scrapers	80
Graders	75
Trucks	75
Paver	80
Materials Handling:	
Concrete mixer	75
Concrete pump	75
Crane	75
Derrick	75
Stationary:	
Pumps	75
Generators	75
Compressors	75
Impact:	
Pile drivers	95
Jackhammers	75
Rock drills	80
Pneumatic tools	80
Other:	
Saws	75
Vibrator	75

Source: City of Burlingame General Plan: Noise Element, City of Burlingame, September 1975.

City of Burlingame Municipal Code. The Building Construction Section of the Municipal Code establishes allowable hours of construction in the City of Burlingame. Chapter 18.07.110 states that no person shall erect, demolish, alter, or repair any building or structure other than between the hours of 7:00 am and 7:00 pm on weekdays, 9:00 am and 6:00 pm on Saturdays, and 10:00 am and 6:00 pm on Sundays and holidays, except under circumstances of urgent necessity in the interest of public health and safety. An exception must be approved in writing by the building official and shall be granted for a period of no more than three days for projects including structures with a gross floor area of less than 40,000 ft^2; when reasonable to accomplish the erection, demolition, alteration, or repair, the exception shall not exceed 20 days for projects including structures with a gross floor area of 40,000 ft^2 or greater.

Existing Noise Environment

The project site is located in Burlingame, California, and is bounded by Myrtle Road to the northeast, Howard Avenue to the southeast, East Lane to the southwest, and commercial land uses to the northwest. Noise sensitive receptors in the vicinity of the project site include residential land uses located to the north and northeast across Myrtle Road. San Francisco International Airport is about three miles northwest of the site. While occasional aircraft overflights are audible, intermittent aircraft noise is not a significant contributor to the ambient noise environment. Railroad tracks run parallel to East Lane as close as 110 feet from the project site. The Burlingame Caltrain Station is also across East Lane. Railroad noise and vehicle traffic noise are the primary sources of noise in the vicinity of the project. A survey of existing commercial uses in the vicinity of the project site revealed that occasional car washes and servicing at the auto dealership to the northwest are temporary stationary noise sources affecting the Site.

A noise monitoring survey was performed on August 5 to 6, 2015 to quantify the existing noise environment on the project site. Two long-term noise measurements (24-hour durations) and two short-term noise measurements (10-minute durations) were conducted at representative locations to complete the noise monitoring survey. Noise measurement locations are shown on Figure 1.

Long-term noise measurement LT-1 was made approximately 45 feet from the centerline of Howard Avenue. The primary noise source at this location is vehicle traffic along Howard Avenue and train noise from stops and pass-bys along the Caltrain corridor. Daytime hourly average noise levels ranged from 62 to 69 dBA L_{eq}, average noise levels during evening hours ranged from 62 to 73 dBA L_{eq}, and nighttime hourly average noise levels ranged from 40 to 72 dBA L_{eq}. The Community Noise Equivalent Level (CNEL) for the measurement ranged from 72 to 73 dBA. Measurement location LT-2 was approximately 26 feet from the centerline of Myrtle Road. The major noise source at this location was local vehicle traffic on Myrtle Road. Daytime hourly average noise levels ranged from 56 to 67 dBA L_{eq}, average noise levels during evening hours ranged from 52 to 64 dBA $L_{eq,}$ and nighttime hourly average noise levels ranged from 42 to 66 dBA L_{eq}. The CNEL throughout the measurement period ranged from 64 to 66 dBA. Noise data collected at the long-term sites are shown in Appendix A.

Two short-term measurements were made in the vicinity of the site. The CNEL noise level was estimated at the short-term locations by comparing the L_{eq} noise level at the short-term measurement site to the concurrent L_{eq} at a nearby long-term measurement site. Locations for the measurements are shown in Figure 1. The first short-term measurement (ST-1) was made across Howard Avenue from the project, approximately 90 feet from railroad tracks to the southwest, 25 feet from the center of Howard Avenue, and about five feet off the surrounding ground. The primary noise sources during the measurement were vehicles along local roadways and a train approaching, stopping, and accelerating from the nearby train stop. The average noise level for the first interval of the measurement was 71 dBA L_{eq} with the inclusion of train events, and a consecutive measurement without a train event resulted in an average noise level of 60 dBA L_{eq}. Estimated CNEL noise levels for the measurement location were calculated to range from 73 to 79 dBA. Short-term measurement ST-2 was southwest of the intersection of Howard Avenue and Myrtle Road, approximately 35 feet from the center of Howard Avenue, 190 feet from railroad tracks, and about five feet off the surrounding ground. The primary noise source during the measurement was vehicles along local roadways. The 10-minute average noise level for the first measurement at this location was 59 dBA L_{eq} and was 62 dBA L_{eq} for the second 10-minute measurement. During the second measurement a stopped Caltrain resulted in noise generated approximately 300 feet away and a pass-by resulted in noise generated as close as 200 feet away. Estimated CNEL noise levels for the measurement location were calculated to range from 70 to 71 dBA. Noise data collected at the short-term sites are shown in Table 7.

FIGURE 1 Noise Measurement Locations

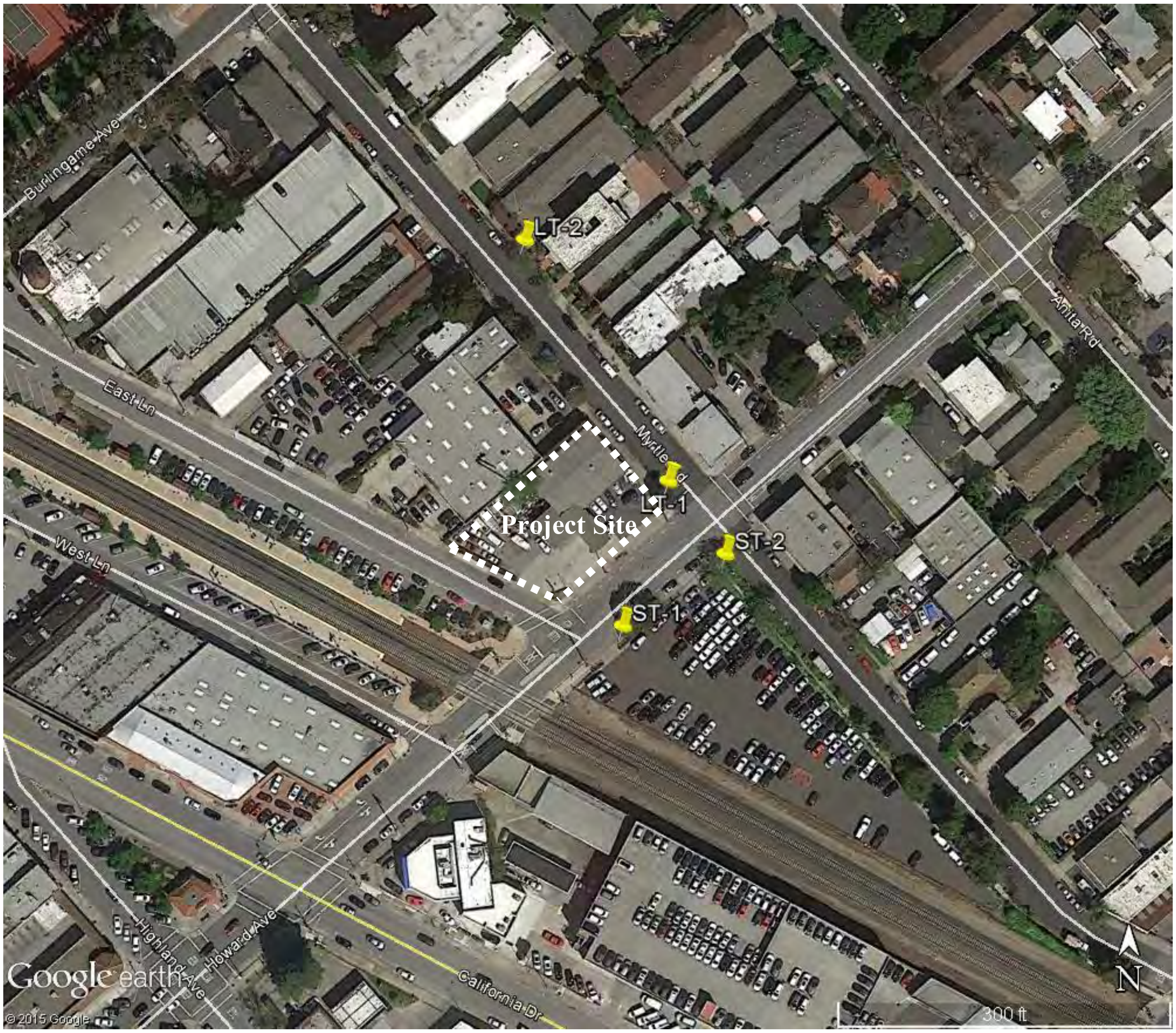


TABLE 7 Short-term Noise Measurement Data

Measurement Location	Date/Time	L_{eq}	L_{max}	$L_{(1)}$	$L_{(50)}$	$L_{(90)}$	CNEL
LT-1: 45 feet from center of Howard Avenue, 230 feet from RR tracks.	8/4/2015-8/6/2015	60*	77*	71*	52*	47*	72-73
LT-2: 26 feet from the center of Myrtle Road.	8/4/2015-8/6/2015	58*	63*	62*	57*	56*	64-66
ST-1: 25 feet from center of Howard Avenue, 90 feet from RR tracks.	8/4/2015 13:33-13:40	71	89	83	62	53	79**
	8/4/2015 13:40-13:49	60	70	68	56	50	73**
ST-2: 35 feet from center of Howard Avenue, 190 feet from RR tracks.	8/4/2015 13:50-14:00	59	75	69	54	49	71**
	8/4/2015 14:00-14:10	62	80	72	56	50	70**

*Average of all daytime measurement intervals
** CNEL estimated based on corresponding long-term noise measurement data.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

Paraphrasing from Appendix G of the CEQA Guidelines, a project would normally result in significant noise impacts if noise levels generated by the project would conflict with adopted environmental standards or plans, if the project would generate excessive groundborne vibration levels, or if ambient noise levels at sensitive receivers would be substantially increased over a permanent, temporary, or periodic basis. The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or the California Building Code.

- A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in "architectural" damage to normal buildings.

- A significant impact would be identified if noise generated by the project would substantially increase noise levels at sensitive receivers in the vicinity. The impact would be considered significant if the project would increase noise levels at noise sensitive receptors by 3 dBA CNEL or greater where exterior noise levels would exceed the normally acceptable noise level standard. Where noise levels would remain at or below the normally acceptable noise level standard with the project, noise level increases of 5 dBA CNEL or greater would be considered significant.

- A significant noise impact would be identified if construction related noise would temporarily increase ambient noise levels at sensitive receivers. Hourly average noise levels regularly exceeding 60 dBA L_{eq} and the ambient by at least 5 dBA L_{eq}, for a period greater than one year would constitute a significant temporary noise increase at adjacent residential land uses.

Impact 1: **Noise and Land Use Compatibility.** Future interior noise levels would be expected to exceed The State Building Code provisions at the proposed office, assuming standard construction methods. **This is a significant impact.**

Future Exterior Noise Environment

The future noise environment at the project site would continue to result primarily from local transportation and Caltrain railroad noise sources in the project vicinity. An exterior commercial roof deck is proposed as part of the project and is assessed as the primary outdoor use area for the project. The future exposure at the western border of the project site is calculated to be up to 77 dBA CNEL. The roof deck is to be located on the eastern portion of the rooftop and would not have line-of-site to train activities to the west. Line-of-sight to traffic along Howard Avenue would also be obscured for the entire deck area for a person sitting down and most of the deck area for a person standing up. Noise levels at the roof top deck would be reduced because of shielding by the proposed building, parapet walls surrounding the deck, and because of increased distance from the western border of the project. Noise would be reduced by greater than 15 dBA as a result of these combined factors. Average daytime noise levels would not exceed 65 dBA L_{eq} at noise sensitive outdoor receivers. Additionally, the land use would not be occupied during nighttime hours. This does not exceed the city's exterior threshold of 65 dBA CNEL. The roof top deck is proposed as an outdoor use area with an adequate noise environment. Balconies proposed on the western and southern façades of the building are not considered noise sensitive due to infrequency of use.

Future Interior Noise Environment

The State of California requires that wall and roof-ceiling assemblies exposed to the adjacent roadways and railroads have a composite Sound Transmission Class (STC)[1] rating of at least 50 or a composite Outdoor-Indoor Transmission Class (OITC) rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the commercial property falls within the 65 dBA CNEL noise contour for a railroad. The State also requires interior noise levels to be maintained at 50 dBA $L_{eq(1\text{-}hr)}$ or less during hours of operation at the proposed office building.

The proposed office building would have direct line-of-sight to the Caltrain railroad and Howard Avenue. The southwestern-facing side of the office building would be approximately 110 to 120 feet from the center of the Caltrain railroad tracks. At this distance, the lower level building façade would be exposed to future exterior noise levels ranging from 66 to 73 dBA $L_{eq(1\text{-}hr)}$.

[1] **Sound Transmission Class (STC)** A single figure rating designed to give an estimate of the sound insulation properties of a partition. Numerically, STC represents the number of decibels of speech sound reduction from one side of the partition to the other. The STC is intended for use when speech and office noise constitute the principal noise problem.

Exterior noise levels at upper levels of the proposed office building would be approximately 5 to 10 dBA higher due to the lack of acoustical shielding. A wall assembly with an STC rating of at least 50 and window assemblies with an STC rating of at least 40 would provide at least 35 to 40 dBA of noise reduction in interior spaces. The inclusion of adequate forced-air mechanical ventilation systems is normally required so windows may be kept closed at the occupant's discretion. The sound-rated construction materials established in the Cal Green Code in combination with forced-air mechanical ventilation would satisfy the threshold for the entire office building.

Mitigation Measure 1:

The following mitigation measures shall be incorporated into the proposed project to reduce exterior interior noise levels:

- Ensure that the interior noise levels are maintained at or below 50 dBA $L_{eq(1\text{-}hr)}$. Treatments would include, but are not limited to, sound-rated wall and window constructions, acoustical caulking, protected ventilation openings, etc. The specific determination of what noise insulation treatments are necessary shall be conducted on a room-by-room basis during final design of the project. Results of the analysis, including the description of the necessary noise control treatments, shall be submitted to the City, along with the building plans and approved design, prior to issuance of a building permit.

- Provide satisfactory forced-air mechanical ventilation, as determined by the local building official, for all exterior-facing rooms of the office building so that windows can be kept closed at the occupant's discretion to control interior noise and achieve the interior noise standards.

Impact 2: **Exposure to Excessive Groundborne Vibration due to Construction.** Construction-related vibration levels resulting from activities at the project site would not exceed 0.3 in/sec PPV at the nearest residential land uses. **This is a less-than-significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include demolition, site preparation work, foundation work, new building framing and finishing, and paving. The proposed project would not require pile driving, which can cause excessive vibration.

For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No ancient buildings or buildings that are documented to be structurally weakened adjoin the project site. Therefore, groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impact.

Table 8 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. The nearest residential land uses would be approximately 75 feet northeast the project site across Myrtle Road. At this distance, vibration levels would be expected to be 0.06 in/sec PPV or less. All vibration levels expected at nearby residences would, therefore, be below the 0.3 in/sec PPV significance threshold. This is a less-than-significant impact.

TABLE 8 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Approximate L_v at 25 ft. (VdB)
Pile Driver (Impact)	upper range	1.158	112
	typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

Mitigation Measure 2: None required.

Impact 3: Project Operations. Operational noise sources would not cause a substantial increase in ambient noise levels in the project vicinity above levels existing without the project. **This is a less-than-significant impact.**

Traffic Noise

Typically, a significant permanent noise increase would occur if the project would increase noise levels at noise sensitive receptors by 3 dBA CNEL or greater where ambient noise levels exceed the normally acceptable noise level standard. Where ambient noise levels are at or below the normally acceptable noise level standard, noise level increases of 5 dBA CNEL or greater would be considered significant. Ambient noise levels at the nearest receptors are above 60 dBA CNEL at times, and would exceed 60 dBA CNEL with the project; therefore, the 3 dBA CNEL or greater significance threshold would apply.

A review of the Trip Generation Analysis prepared by *Nelson Nygaard Consulting Associates Inc.* (dated September 8, 2015) concluded that the proposed project would reduce the overall vehicle trip generation, resulting in a net reduction of vehicle trips. The traffic noise generated as a result of the project would be less than existing conditions resulting in a less-than-significant impact.

Parking Lot Noise

An enclosed parking lot is to be located on the at-grade plan level of the project site. The entrance and exit would share the same driveway accessed via East Lane along the western border of the project site. Noise-generating activities (vehicle circulation, engine starts, door slams, etc.) at the parking lot would generally coincide with activities in the existing use at the site parking lot. The nearest noise sensitive receiver to the proposed parking garage entrance is more than 230 feet northwest. Additionally, the proposed office building would provide shielding, obscuring line-of sight. On an hourly average or daily average basis, the operation of the proposed parking lot would not substantially increase ambient noise levels above levels existing without the project.

Noise from Mechanical Equipment

The project would locate operational sources of noise such as mechanical equipment adjacent to existing residential housing. Proposed structures on site would include ventilation systems that would be expected to generate relatively low noise levels. Such ventilation systems would be designed with standard Building Code requirements and would not be expected to generate noise levels exceeding existing conditions either within or outside of the project area. Future noise levels due to mechanical equipment operation is not expected to be noticeable above existing traffic noise levels at nearby noise-sensitive uses and this impact is considered less than significant.

Mitigation: None Required.

Impact 4: **Construction Noise.** The construction of the project would elevate noise levels at nearby noise-sensitive land uses located near the site for a period of less than 12 months. **This is a less-than-significant noise impact.**

The development of the project is expected to generate noise and would temporarily increase noise levels at nearby sensitive land uses. Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise generating activities, and the distance between construction noise sources and noise sensitive receptors and existing ambient noise levels. Construction activities generate considerable noise, especially during the demolition phase and the construction of project infrastructure when heavy equipment is used.

Project construction phases and activities would include demolition, site preparation, grading/excavation, trenching, exterior building, interior building, and paving. The highest noise levels would be generated during demolition and the foundation, building framing, and siding. During construction, maximum noise levels would vary depending on the equipment operating on site. The typical range of maximum noise levels would be 80 to 90 dBA L_{max} at a distance of 50 feet. Hourly average noise levels generated by construction are about 78 dBA to 89 dBA L_{eq} measured at a distance of 50 feet from the center of a busy construction site. Construction generated noise levels drop off at a rate of about 6 dBA per doubling of distance between the source and receptor. Shielding provided by barriers or structures can provide an additional 5 to 10 dBA noise reduction at distant receivers.

The nearest noise sensitive receivers would be a multi-family residence located 75 feet northeast of the project site across to Myrtle Road. Typical hourly average construction-generated noise levels would be anticipated to be 74 to 85 dBA L_{eq} outside the nearest residence during busy construction periods when construction is taking place in the northernmost portion of the site. Existing daytime noise levels at the residences range from 57 to 68 dBA L_{eq}, so the threshold level would be the existing level plus 5 dBA, or 62 to 73 dBA L_{eq}. Construction activities throughout the project site would intermittently exceed the threshold at noise sensitive receivers to the north and northeast. It is anticipated that the exposure to construction noise above the threshold levels would occur for a period of less than 12 months.

The following standard controls are assumed in the analysis to reduce construction noise impacts to a less-than-significant level:

- Noise-generating activities at the construction site or in areas adjacent to the construction site associated with the project in any way should be restricted to the hours of 7:00 am to 6:00 pm, Monday through Friday, and 9:00 am to 5:00 pm on Saturdays. No construction activities should occur Sundays or holidays.

- Equip all internal combustion engine driven equipment with intake and exhaust mufflers which are in good condition and appropriate for the equipment.

- Locate stationary noise generating equipment (e.g., concrete crusher) as far as possible from sensitive receptors. Acoustically shield such equipment with temporary noise barriers, material stockpiles, etc. to reduce noise levels at nearby residences.

- Utilize "quiet" air compressors and other stationery noise sources where technology exists.

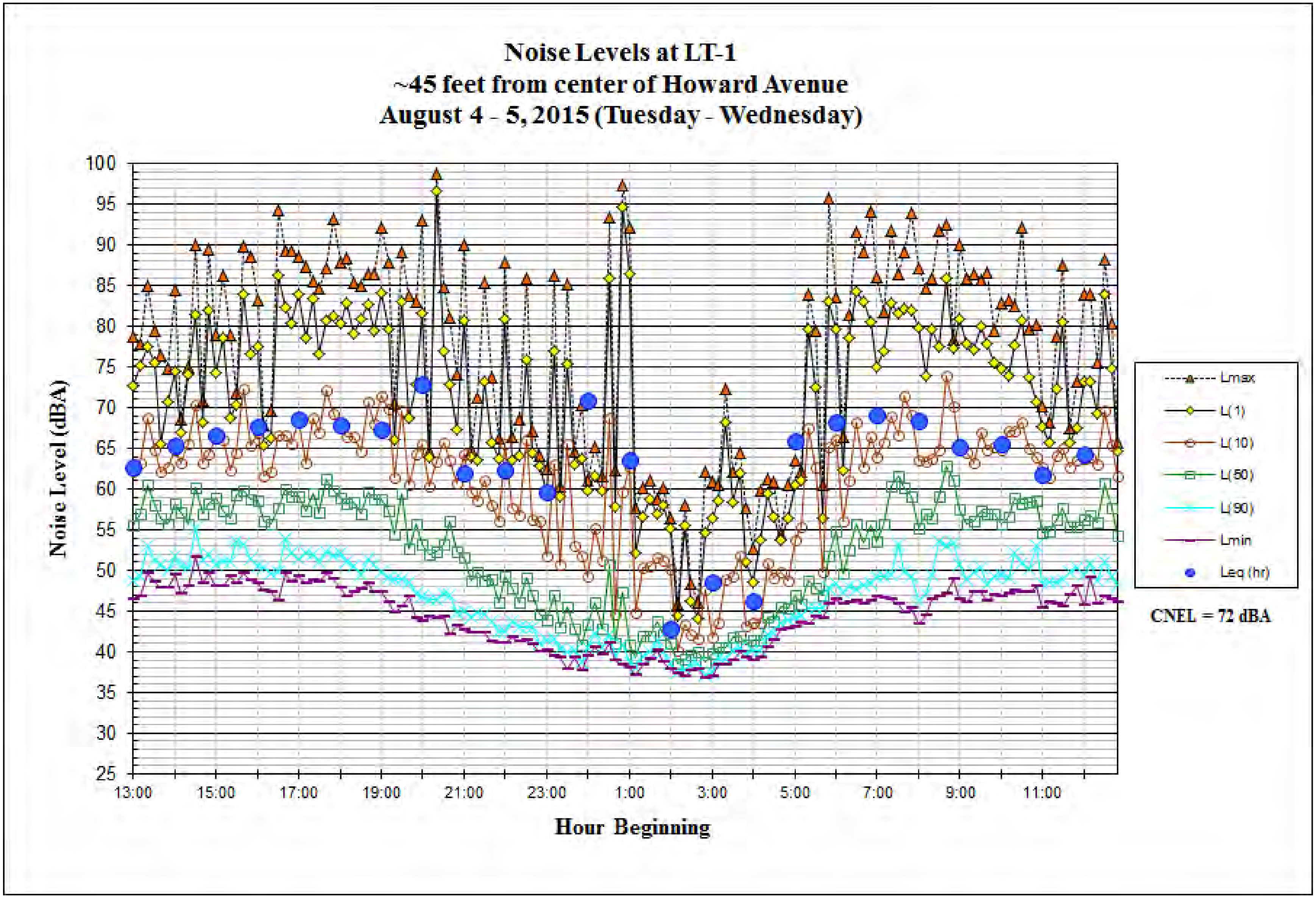
- The contractor shall prepare a detailed construction plan identifying the schedule for major noise-generating construction activities. This plan shall be distributed to noise-sensitive uses within 1,200 feet of the project site.

- Designate a "disturbance coordinator" who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem be implemented. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

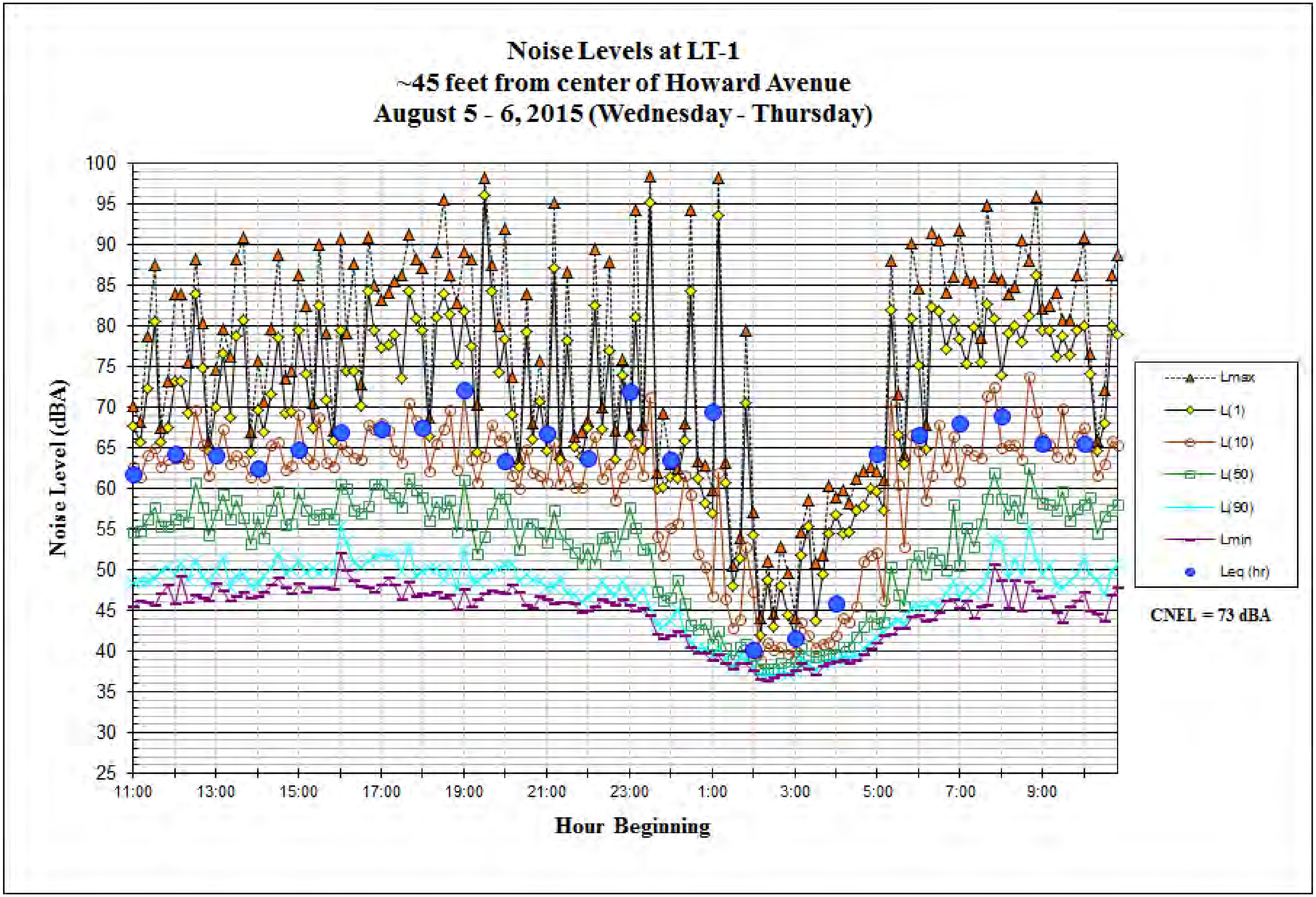
With the incorporation of these standards measures, the noise impact resulting from project construction would be considered less-than-significant.

Mitigation: None Required.

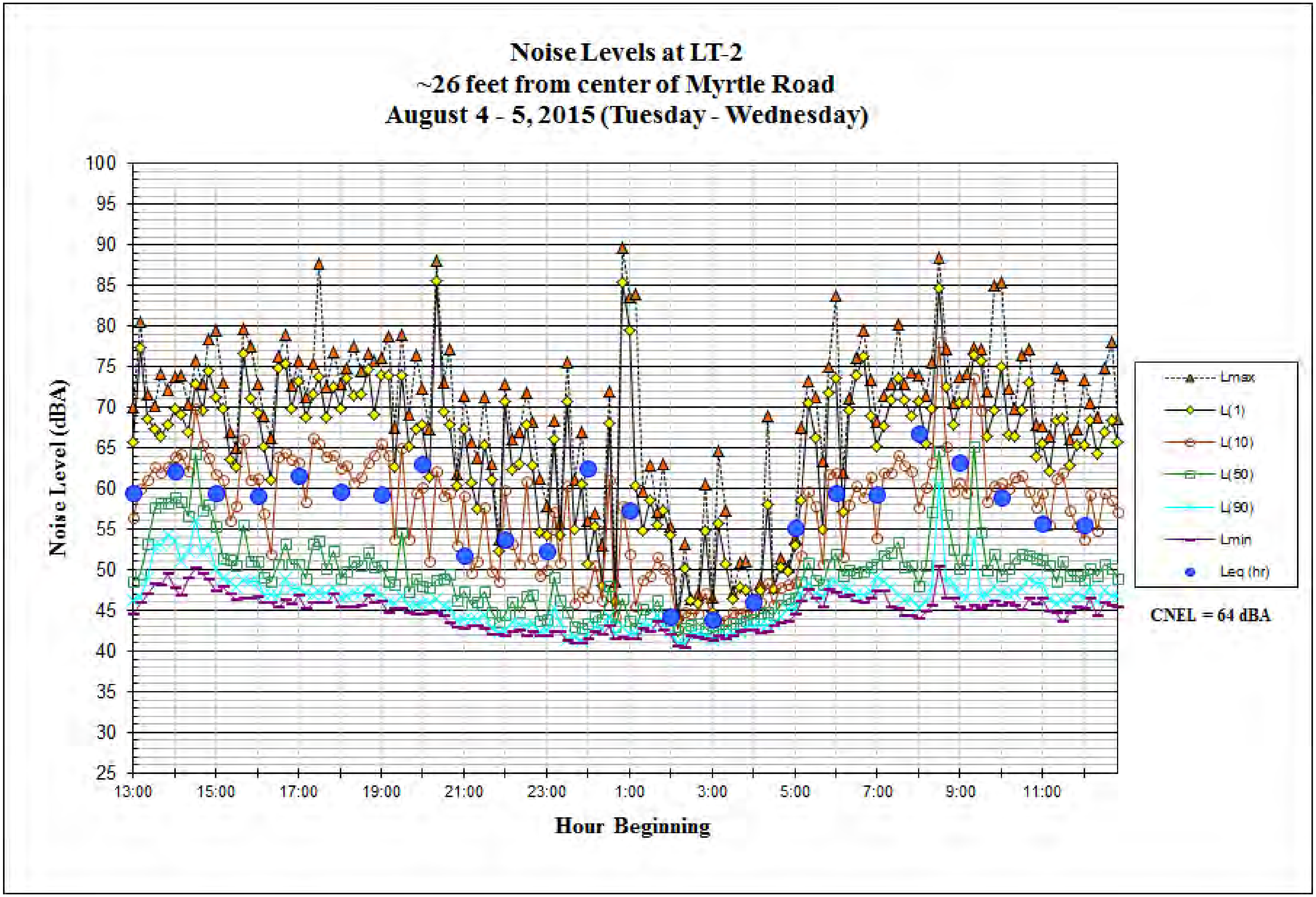
APPENDIX A

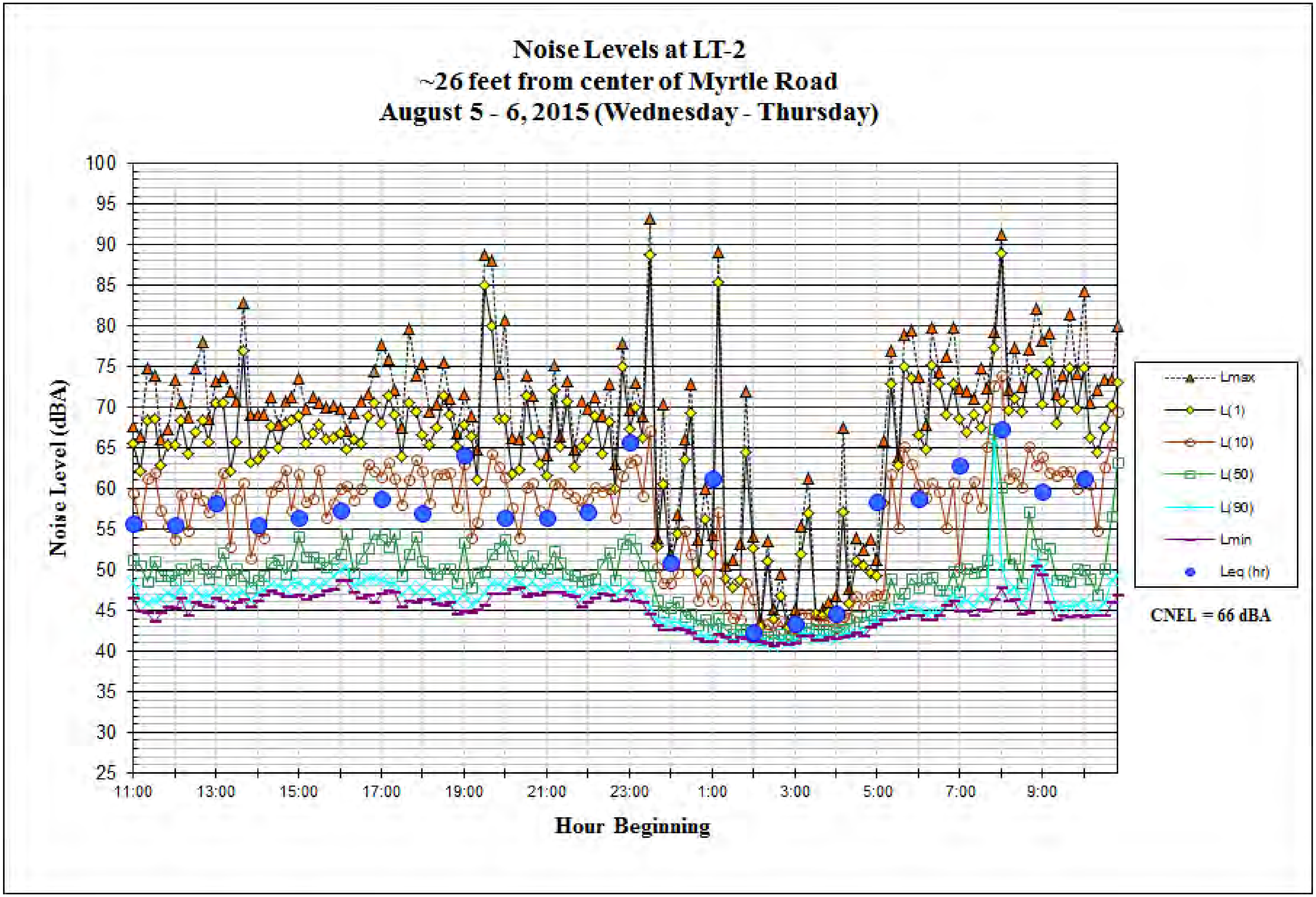


Noise Levels at LT-1
~45 feet from center of Howard Avenue
August 4 - 5, 2015 (Tuesday - Wednesday)
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
13:00
15:00
17:00
19:00
21:00
23:00
1:00
3:00
5:00
7:00
9:00
11:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
CNEL = 72 dBA



Noise Levels at LT-1
~45 feet from center of Howard Avenue
August 5 - 6, 2015 (Wednesday - Thursday)
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
11:00
13:00
15:00
17:00
19:00
21:00
23:00
1:00
3:00
5:00
7:00
9:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
CNEL = 73 dBA


Noise Levels at LT-2
~26 feet from center of Myrtle Road
August 4 - 5, 2015 (Tuesday - Wednesday)
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
13:00
15:00
17:00
19:00
21:00
23:00
1:00
3:00
5:00
7:00
9:00
11:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
CNEL = 64 dBA



Noise Levels at LT-2
~26 feet from center of Myrtle Road
August 5 - 6, 2015 (Wednesday - Thursday)
Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
11:00
13:00
15:00
17:00
19:00
21:00
23:00
1:00
3:00
5:00
7:00
9:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
CNEL = 66 dBA